

## CLAIMS

We claim:

- 5 1. An iterative equalizer for a data communication system for recovering received data transmitted over a data channel comprising:
- a first filter for filtering received data according to first filter parameters to generate first-filtered data;
  - a combiner for modifying the first-filtered data with second-filtered data to generate modified data;
  - a decision device for generating modified tentative decisions based on the modified data, the modified tentative decisions being modified with respect to tentative decisions of a previous iteration; and
  - a second filter for filtering tentative decisions from a previous iteration according to second filter parameters to generate said second-filtered data;
- 10 wherein said first and second filter parameters are based on the received data.
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2. The equalizer of claim 1 wherein the first and second filter parameters are modified at each iteration.
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3. The equalizer of claim 1 wherein the equalizer is fractionally-spaced in that the received data is sampled at a rate higher than a symbol rate associated with the received data.
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4. The equalizer of claim 1 wherein the received data comprises symbol data.
5. The equalizer of claim 1 wherein the first and second filter parameters are modified at each iteration according to channel parameters that are re-estimated at each iteration based on the received data.
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6. The equalizer of claim 1 wherein the received data is encoded for error-correction coding, and wherein the decision device comprises an error-correction decoder and further comprising an encoder for error-correction encoding the tentative decisions from a previous iteration.
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7. The equalizer of claim 1 wherein the first and second filters comprise filter types selected from the group of filter types consisting of: linear, non-linear, time-variant, time-invariant, infinite-impulse-response, and finite-impulse-response filters.
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8. The equalizer of claim 1 wherein the received data comprises a plurality of received signals received over a plurality of said data channels, and wherein the equalizer further comprises a like plurality of said first filters corresponding to the plurality of channels.
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9. The equalizer of claim 1 wherein the received data comprises combined data for a plurality of users, and wherein the equalizer further comprises a like plurality of said second filters corresponding to the plurality of users.
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10. The equalizer of claim 1 wherein the first filter, combiner, decision device and second filter are distributed among a data channel transmitter and receiver.
11. An iterative equalizer for a data communication system for recovering received data transmitted over a data channel having channel parameters comprising:
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- a first filter for filtering received data according to first filter parameters to generate first-filtered data;
  - a combiner for modifying the first-filtered data with second-filtered data to generate modified data;

a decision device for generating modified tentative decisions based on the modified data, the modified tentative decisions being modified with respect to tentative decisions of a previous iteration; and

a second filter for filtering tentative decisions from a previous iteration according to second filter parameters to generate said second-filtered data;

wherein said first and second filter parameters are based on an estimate of said channel parameters, and wherein the received data is encoded for error-correction coding, and wherein the decision device comprises an error-correction decoder and further comprising an encoder for error-correction encoding said tentative decisions from a previous iteration.

12. The equalizer of claim 11 wherein said first and second filter parameters are modified at each iteration.

13. An iterative equalizer for a data communication system for recovering received data transmitted over a plurality of data channels comprising:

a first filter for filtering received data according to first filter parameters to generate first-filtered data;

a combiner for modifying the first-filtered data with second-filtered data to generate modified data;

a decision device for generating modified tentative decisions based on the modified data, the modified tentative decisions being modified with respect to tentative decisions of a previous iteration; and

a second filter for filtering tentative decisions from a previous iteration according to second filter parameters to generate said second-filtered data;

wherein said first and second filter parameters are based on an estimate of said channel parameters, and wherein the received data comprises a plurality of received signals received over the plurality of data channels, and wherein the equalizer further comprises a like plurality of said first filters corresponding to the plurality of channels.

14. The equalizer of claim 13 wherein said first and second filter parameters are modified at each iteration.
15. An iterative equalizer for a data communication system for recovering received data transmitted over a data channel comprising:
  - a first filter for filtering received data according to first filter parameters to generate first-filtered data;
  - a combiner for modifying the first-filtered data with second-filtered data to generate modified data;
  - a decision device for generating modified tentative decisions based on the modified data, the modified tentative decisions being modified with respect to tentative decisions of a previous iteration; and
  - a second filter for filtering tentative decisions from a previous iteration according to second filter parameters to generate said second-filtered data;wherein said first and second filter parameters are based on an estimate of said channel parameters, and wherein the equalizer is fractionally spaced in that the received data is sampled at a rate higher than a symbol rate associated with the received data.
16. The equalizer of claim 15 wherein said first and second filter parameters are modified at each iteration.
17. A method for recovering received data transmitted over a data channel in a data communication system comprising iteratively:
  - first-filtering received data according to first filter parameters to generate first-filtered data;

modifying the first-filtered data with second-filtered data to generate modified data;

generating modified tentative decisions based on the modified data, the modified tentative decisions being modified with respect to tentative decisions of a previous iteration; and

second-filtering tentative decisions from a previous iteration according to second filter parameters to generate said second-filtered data;

wherein said first and second filter parameters are based on the received data.

18. The method of claim 17 further comprising modifying the first and second filter parameters at each iteration.

19. The method of claim 17 wherein the received data is sampled at a rate higher than a sample rate associated with the received data.

20. The method of claim 17 wherein the received data comprises symbol data.

21. The method of claim 17 further comprising modifying the first and second filter parameters at each iteration according to channel parameters that are re-estimated at each iteration based on the received data.

22. The method of claim 17 wherein the received data is encoded for error-correction coding, and wherein generating modified tentative decisions based on the modified data comprises error-correction decoding the modified data and further comprising error-correction encoding the tentative decisions from a previous iteration.

23. The method of claim 17 wherein the first and second filters comprise filter types selected from the group of filter types consisting of: linear, non-linear, time-

variant, time-invariant, infinite-impulse-response, and finite-impulse-response filters.

24. The method of claim 17 wherein the received data comprises a plurality of received signals received over a plurality of said data channels, and further comprising first-filtering the received data at a plurality of first filters corresponding to the plurality of channels.

25. The method of claim 17 wherein the received data comprises combined data for a plurality of users, and further comprising second-filtering the tentative decisions from a previous iteration at a plurality of second filters corresponding to the plurality of users.

26. The method of claim 17 wherein the first filter, combiner, decision device and second filter are distributed among a data channel transmitter and receiver.

27. A method for recovering received data transmitted over a data channel having channel parameters, in a data communication system, comprising iteratively:

- first-filtering received data according to first filter parameters to generate first-filtered data;
- modifying the first-filtered data with second-filtered data to generate modified data;
- generating modified tentative decisions based on the modified data, the modified tentative decisions being modified with respect to tentative decisions of a previous iteration; and
- second-filtering tentative decisions from a previous iteration according to second filter parameters to generate said second-filtered data;
- wherein said first and second filter parameters are based on an estimate of said channel parameters, and wherein the received data is encoded for error-correction coding, and wherein generating modified tentative decisions based on

the modified data comprises error-correction decoding the modified data and further comprising error-correction encoding the tentative decisions from a previous iteration.

5 28. The method of claim 27 further comprising modifying the first and second filter parameters at each iteration.

29. A method for recovering received data transmitted over a plurality of data channels having channel parameters, in a data communication system, comprising iteratively:

10 first-filtering received data according to first filter parameters to generate first-filtered data;

modifying the first-filtered data with second-filtered data to generate modified data;

15 generating modified tentative decisions based on the modified data, the modified tentative decisions being modified with respect to tentative decisions of a previous iteration; and

second-filtering tentative decisions from a previous iteration according to second filter parameters to generate said second-filtered data;

20 wherein said first and second filter parameters are based on an estimate of said channel parameters, wherein the received data comprises a plurality of received signals received over the plurality of data channels, and further comprising first-filtering the received data at a plurality of first filters corresponding to the plurality of channels.

25 30. The method of claim 29 further comprising modifying the first and second filter parameters at each iteration.

31. A method for recovering received data transmitted over a data channel having channel parameters, in a data communication system, comprising iteratively:

first-filtering received data according to first filter parameters to generate first-filtered data;

modifying the first-filtered data with second-filtered data to generate modified data;

5 generating modified tentative decisions based on the modified data, the modified tentative decisions being modified with respect to tentative decisions of a previous iteration; and

second-filtering tentative decisions from a previous iteration according to second filter parameters to generate said second-filtered data;

10 wherein said first and second filter parameters are based on an estimate of said channel parameters, and wherein the received data is sampled at a rate higher than a symbol rate associated with the received data.

32. The method of claim 31 further comprising modifying the first and second filter parameters at each iteration.